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Small Farms

Research Update

USDA, ARS, SPA

Winter 2003

Agroforestry

Introduction

Happy New Year! 2003 was a good year for the Center. The research staff was productive. All of the scientists at the Location and most of the staff attended at least one, if not several meetings for landowners and producers. Our field day for the year was very successful and featured research results related to sheep and goat production. We look forward to seeing you at an event/meeting in 2004.

This issue update summarizes recent progress in the Center's agroforestry project.

Eastern Black Walnut Variety Trials

Currently the Center has 4 variety trials of Eastern Black Walnuts- one at Booneville and three in north central Tennessee. A fifth is to be established during the winter of 2003/2004 in the western part of Tennessee at Millington. A sixth is planned at Booneville in the winter of 2004-2005. All trials used grafted seedling trees produced by the RPM@ method at Forrest Keeling Nursery (Disclaimer: Mentioning of a brand does not constitute an endorsement by USDA over others). Silvicultural practices have been similar at all sites. Trees received generous quantities of fertilizer throughout the growing season. A mixture of landscape cloth and herbicide applications was used to control competing vegetation.

Booneville trial: Eight scion-rootstock combinations were planted in December 1999. In 1999, the Forrest Keeling Nursery was using several varieties as rootstock. Therefore, the entries in the Booneville trial represent a mixture of scion and rootstock combinations as listed in the table below.

The scions and rootstocks of the 8 entries of Eastern Black Walnuts being evaluated at Booneville AR

Scion	Rootstock(s)
Emma Kay	Tomboy or Kwik Krop
HPC 148	Sparrow
Kwik Krop	Thomas
Ogden	Sparks 127
Sauber Wilmot	Thomas
Sparrow	Emma Kay or Thomas
Surprise	Purdue #1
Thomas	Thomas

The Booneville site is a gently sloping hillside. The upper part of the plot has an Enders silt loam which transitions into a Leadvale silt loam at the bottom. The main difference between Enders and Leadvale is the existence of a fragipan in the Leadvale that decreases water infiltration and can limit root penetration. Black walnuts are not recommended for either of these soil types. The major limitation of the Enders for walnut production is the lack of available soil moisture. Therefore, plans were made from

the study's beginning that supplemental water would be supplied by drip irrigation. At the end of the third growing season (i.e. October of 2002), scions of HPC 148, Sauber, and Thomas were superior in survival and tree height to the 5 other entries. Survival and tree growth of Ogden was least among the 8 entries. Tree survival was better for those located on the more upland part of the site where the soil type is an Enders silt loam. Walnut survival on the lower part of the slope, where the soil type is a Leadvale, has been poor. In fact after repeatedly replacing trees at certain locations on the Leadvale soil, the decision was made in the fall of 2003 that white oak seedling trees would be used as replacement trees in future years.

Nut production in 2000, 2001, and 2002 was low. In 2002, scions of Kwik Krop and Sauber produced the most nuts, about 10 and 5 nuts per tree, respectively. Nut production was significantly greater in 2003. As in 2002, Kwik Krop scions produced the most nuts in 2003. Nut production by Emma Kay was second highest, followed by Sauber, Surprise, and Thomas. Nut production in 2003 was least with Sparrow scions.

Nut Production in 2003 by scion variety at Booneville, AR

<u>Scion</u>	<u>Average Number of Nuts per tree</u>
Emma Kay	34
HPC 1	12
Kwik Krop	85
Sauber	22
Sparrow	6
Surprise	20
Thomas	17

Tennessee Sites. Dr. Joshua Idassi, Tennessee State University (TSU), is an important cooperator in all three of these trials. The Tennessee trials compare the growth of 4 varieties, Sauber, Sparrow, Emma Kay, and Kwik Krop. These four scions were chosen because of their success at the Booneville trial and an ongoing trial at the Forrest Keeling Nursery located near Elsberry Missouri. All of these scions were grafted onto Kwik Krop rootstock. All three trials were established during the winter of 2000-2001, one at TSU's Cheatham county farm (near Ashland City), one just west of Clarksville, and the third just south of Springfield. The soil at the Clarksville site is an Arrington silt loam transitioning into a Baxter silt loam on the slope. Soil at the Cheatham county site is a Nolin silt loam transitioning into a Linside silt loam. The soil on the lower part of the slope at the Springfield site is a Sango silt loam, transitioning into a Dickson silt loam as one moves up the slope. Black walnuts are highly recommended for planting on all of these soil types except for the Sango and Dickson silt loams. Sango silt loam tends to have a fragipan fairly deep in the subsoil and thus may not be ideally suited to black walnuts. The Dickson soil type has a fragipan fairly close to the surface, which reduces water permeability and thus walnuts are not an appropriate tree species for planting in this soil.

At the Springfield site, 92% of the trees (36/39) were alive at the end of the second growing season (i.e. fall of 2003). The average tree height was 52 inches. Two trees had a total of 4 nuts. Three trees that died at the Springfield site were located further up the slope, most likely being on the Dickson soil type. Eighty-eight percent of the trees (28/32) were alive at the end of the second growing season in Cheatham county. Average tree height was 50 inches. Only one tree at the Cheatham county site had nuts for a total of 2 nuts in 2003.

Survival was least at the Clarksville site: 53% of the trees (17/32) were alive at the end of the growing season. Average tree

height was 57 inches. Most of the trees that died at the Clarksville site were located in a low spot where the only exit for water is a limestone sink hole. Despite the fact that the soil is well drained, water stood several feet deep in this area at least once each spring since transplanting. Spring rainfall totals in 2002 and 2003 have exceeded the long-term averages. The trees that survived have grown well. These flood events have probably contributed to the lower survival at the Clarksville site.

For comparison sake, 80% of the trees were alive at the end of the second growing season at the Booneville site. Average tree height was 59 inches. The data for the Booneville site was the average of all 8 entries, and therefore included data from the varieties that have not done well at Booneville.

The results from these 4 trials indicate that walnuts can be intensively grown over a variety of conditions with varying degrees of success.

Establishment methods for walnut agroforestry practices in floodplains

Prior to the winter of 2001, well drained soils of high water holding capacity on the Center was unknown. An intensive survey during the winter of 2001 discovered small parcels with a Spadra silt loam soil adjoining portions of Fletcher creek. The Spadra soil being well drained and deep is ideally suited for walnut trees.

An experiment was started in the winter of 2002 to determine the effects of type of seedling tree and planting design on the establishment of walnuts. The experimental design consists of three treatments: 1) bare root stock of green ash and black walnut planted on 12 x 12 foot spacing and managed for nut production; 2) similar to treatment #1 except managed for timber production; 3) RPM@ seedling walnut seedling trees planted on 24 x 24 foot spacing.

Trees were planted in November 2002. As of September, 2003, i.e. end of first growing season, 81% of the bare root walnut

had survived as compared to 94 to 95 % of the RPM@ walnuts and bare root green ash trees. Average tree height changed little over the growing season for bare root walnut seedlings. The height of RPM@ walnut seedling trees increased about 6 inches by the middle of July and then remained constant over the rest of the growing season. Bare root seedlings of green ash almost tripled in height from about 7 to over 20 inches during the growing season.

Plans are underway to measure the movement of water and plant nutrients in the soil behind these treatments to determine the functionality of these designs as riparian buffers to protect the quality of the water in the adjoining streams.

Economics of Pecan Silvopasture Systems

One of the most common forms of silvopasture (co-production of livestock and trees) in the United States is founded in the northern range of pecan's natural range, i.e. northeast OK, southeast KS, and MO. Along river bottoms in this range, native pecans are grown in association with forages, which are used to produce beef, in most cases cow-calf operations. Pecan nuts from these silvopasture practices account for a significant portion of the pecan production in this region. Little is known about forage and timber yields for this practice. There is concern among these producers because pecan nut prices adjusted for inflation have been declining since the late 1970's while cost of production has increased. This study was undertaken to determine: 1) trends in nut production, 2) potential forage and timber yields, and 3) economics of these pecan silvopasture under different scenarios.

This study was conducted in cooperation with Dr. William Reid, Kansas State University's Southeast Pecan Research Station located near Chetopa, KS. We examined nut, timber, and forage production of typically managed pecan silvopasture in southeast KS. Annual hulled nut production varied from 50 to 1,600 pounds per acre from 1981 to 2000 in stands

averaging 72 years of age and ranging in density from 16 to 35 trees per acre. Nut yields had a clear pattern of alternative bearing, i.e. high yield followed by a year with low yields. Tree trunk diameter and basal area increased linearly with age; however, nut production was not related to either tree age or stand basal area.

Merchantable timber yields from thinnings to prevent tree canopies from overlapping ranged between 0.3 and 2.5 cubic yards per acre per year. Forage production varied between 1,500 and 4,500 pounds of dry matter per acre per year. Most of this forage was produced early in the growing season. This information was used to analyze income potential of different management schemes for these pecan silvopastures. Overall income was determined primarily by pecan nut sales. Calf sales significantly increased profitability. The profitability of this practice could be enhanced significantly (possibly doubled) by marketing the timber from the selective thinning of trees, a practice that is not routinely done at this time.

Economics of Eastern Black Walnut Production

There are few data sets on growth of temperate agroforestry tree species to run, validate, and refine economic models for various agroforestry practices. This applies to black walnut (*Juglans nigra* L.), one of the most valuable timber species in the U.S. and a prime tree for agroforestry practices. Timber harvests amount to >500,000 cubic yards per year from 30 states. Recent commercial nut production has averaged 10,000 tons annually. The bulk of commercial nut production comes from native trees. However, more of the nut production is coming from so-called "improved varieties" that were selected for higher nut yield and percent kernel. The site index (SI) characterizes tree growth potential on a given location. Given the fact that SI has been defined for fully stocked stands, its application

may be limited in low-density stands such as those in agroforestry or nut systems.

In this study, we examined height and stem diameter growth of black walnut stands across a representative area of the central United States, and their relationship with site conditions, genotype, and stand configuration. Data were collected during the fall-winter of 2001-2002 from 54 black walnut stands at research sites and on privately owned land from TN to NE. The site index (i.e., SI, mean dominant height, at age 25 years) ranged between 15 and 65 feet, and was independent of stand density. There were no differences in height and stem diameter (DBH) growth rates between stands with improved varieties and native stock. Mean annual increments in DBH and height were positively related both for improved varieties and native stock. Understory competition had a substantial detrimental effect on DBH.

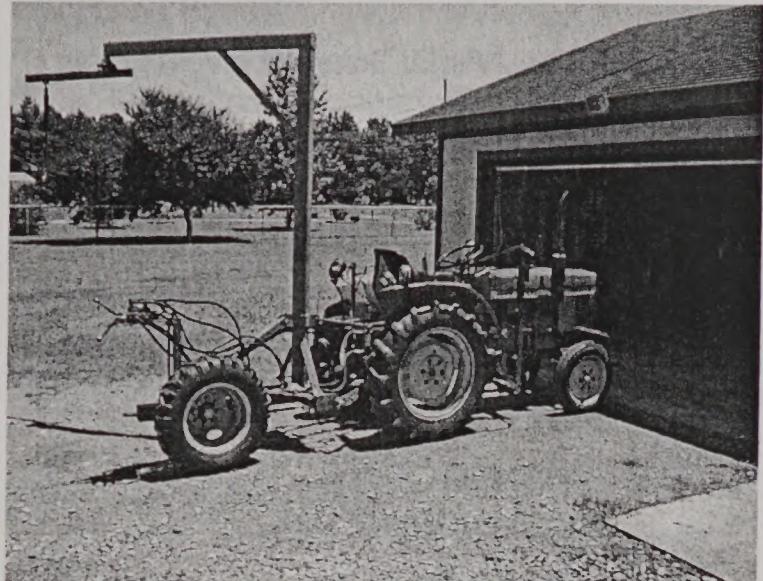
Initially we were planning to use a relationship between tree trunk diameter and nut yields developed from native tree data growing in the Tennessee River Valley in the 1940's. Anecdotal observations while collecting the above tree growth data led us to believe that the relationship between tree trunk diameter and nut yields developed in the 1940's may not be valid under today's management and improved varieties. Nut yields were measured for 12 plots in 2002 and 2003. Predicted nut yields in 2002 varied between 0 and 1,370 pounds of hulled nuts per acre. Nut yields were highly variable within and among stands, and were related to DBH in native stock but not in improved varieties. Nut yields for trees in these plots will be monitored until 2005 (or longer) to determine annual variations in yields and possible relationship between trunk diameter and nut yields so potential economic returns from eastern black walnut agroforestry practices can be realistically estimated.

A Remote-Operated Christmas Tree Shearing Rig

Christmas tree production can be a highly profitable enterprise for small farms. Average retail prices increased steadily from about \$25 per tree in 1992 to \$36 per tree in 2002. An estimated 33 to 35 million families (33% of U.S. households) chose live trees for the 2002 Christmas season, totaling \$1.2 billion in national sales. However, increased costs of production, changing markets (wholesale vs. retail), competition with artificial trees, aging of producers, and labor demands have caused a precipitous decrease in the number of Christmas tree producers within the past few decades. Tree shearing is one of the most labor intensive operations of the Christmas tree producer. During shearing, workers are subject to exhaustion, muscle fatigue, and exposure to adverse weather and insects.

Joe Schilling operates Schilling Christmas Tree Farm near Jacksonville, Arkansas. He grows trees on raised beds because of the heavy soil. The beds are about 3.5' wide and raised about 6" above the alley middle. During shearing, the worker steps up and down from the bed several times while walking around each tree, lugging a 30 lb, hand-held shearing machine. To help reduce some of the tiresome drudgery of tree shearing and increase safety, Mr. Schilling developed a tractor-drawn rig designed for remote, walk-behind operation which supports a standard hand-held shearing machine.

Using this rig, worker productivity on a daily basis is comparable to, or greater than, that of a worker shearing with a hand-held machine. The unique feature of this rig is its remote, walk-behind operation, an innovation that could be used in other field applications such as mechanical weeding, chemical spraying, and harvesting. Further information on equipment design, construction, and operation may be seen in the article, "OTannenbaum, Christmas tree shearing by a remote-operated rig", by J. Schilling and D. Burner, *Resource magazine (ASAE)*, 2003, vol. 10(12), pages 9-10.



The remote-operated rig is shown hitched to a John Deere 750 tractor (shearing machine not shown). Rig and tractor measure 4.7' wide x 13.5' long x 9.6' tall.

Dale Bumpers Small Farms Research Center is a partnership among three institutions:

ARS- conducts research related to livestock production and agroforestry; ARS staff can be reached at 479-675-3834.

PMC/NRCS- evaluation of vegetation and vegetation technology to retain soil and its productive capability; NRCS staff can be reached at 479-675-5182.

Division of Agriculture / University of Arkansas- dissemination of agricultural information. Extension Specialist, Billy Moore, can be reached at 479-675-5585.

ARS scientists at DBSFRC and their primary research focus:

David Brauer- Agronomist/Research Leader investigating both agroforestry and livestock production

Dale Bumpers Small Farms Research

David Burner- Agronomist investigating crop production in agroforestry systems

Joan Burke- Animal Scientist investigating reproductive performance in cattle and production practices for hair sheep

Michael Looper - Animal Scientist investigating beef cattle production.

Dan Pote- Soil Scientist investigating the effects of management practices on sediment and nutrient retention in agroforestry and livestock production systems.

Organizations promoting agriculture in the Ozark Region

The information below is not an exhaustive list of organizations trying to help farmers and ranchers in the Ozarks. If your organization is interested in being included, please contact David Brauer.

Poultry Production and Product Safety Research Unit (PPPSRU)/ARS/USDA/Center of Excellence for Poultry Science is located on the campus of the University of Arkansas in Fayetteville. PPSRU conducts research to solve problems related to: 1) diseases and physiological disorders that are of economic important to the poultry industry; and 2) land application of waste from the poultry production. PPPSRU can be reached at 479-575-4202 or on the world wide web at www.uark.edu/~usdaars/.

South Central Agricultural Research laboratory (SCARL)/ARS/USDA conducts multi-disciplinary research for developing technologies to establish and sustain production and post harvest quality of alternative crops such as vegetables, small fruits, and kenaf. The Laboratory is co-located with the Oklahoma State University's Wes Watkins Research and Extension Center in Lane, OK. SCARL can be reached by phone at 580-889-7395 or on the world wide web at www.lane-ag.org.

Shirley Community Development

Corporation (SCDC) is a community-based organization formed to plan and initiate short-and long-term development programs for Shirley, AR and the surrounding communities. These programs focus on economic development, educational enhancement, youth job training, and service projects that improve and strengthen the community. SCDC is involved in projects that research and demonstrate the skills and techniques needed for production and marketing of specialty agricultural crops. The present focus is on log-grown Shiitake mushrooms. SCDC operates the Shiitake Mushroom Center as a training center. Recent additions include on-site production of garden bricks and stepping stones, raised bed herbal plots, twin wall polycarbonate greenhouse, and compost demonstration project. SCDC can be reached by phone at (501) 723-4443 or on the web at <http://www.shiitakecenter.com/index.html>.

The Kerr Center for Sustainable Agriculture in Poteau, OK offers leadership and educational programs to those interested in making farming and ranching environmentally friendly, socially equitable, and economically viable. The Kerr Center can be reached by phone at 918-647-9123, by email at mailbox@kerrcenter.com or on the web at www.kerrcenter.com.

ATTRA, Appropriate Technology Transfer for Rural Areas, is the national sustainable agriculture information center. ATTRA provides technical assistance to farmers, Extension agents, market gardeners, agricultural researchers, and other ag professionals. ATTRA is located in Fayetteville, AR. ATTRA staff members prefer to receive requests for information at 800-346-9140. ATTRA maintains a web site at www.attra.org.

The Grassroots Grazing Group (GGG) is a network of livestock producers mainly from northwest Arkansas but includes producers from many other states including Virginia, Missouri, and Oklahoma. GGG maintains a electronic mailing list on which members routinely share information and opinions regarding various topics on forage management and livestock production. Members meet monthly, usually at a member's farm, to see and discuss information related to grazing practices. Individuals interested in joining the GGG should contact Ann Wells at annw@ncatark.uark.edu.

The Center for Advancement of American Black Walnut is a non-profit organization promoting the planting of an improved variety of eastern black walnut for nut production. For more information contact the Center's Director, Jim Jones, at P. O. Box 600, Stockton, MO 65785, 417-276-6010 (voice), 417-276-6011 (fax), or jonesctr@hotmail.com (e-mail).

Information regarding the **Arkansas Cooperative Extension Service and the Division of Agriculture** can be found on the internet at the following web site:
www.uaex.edu.

Attention

Are you interested in a person to speak at a meeting of your civic or agricultural group? If so, please contact David Brauer at 479-675-3834 to see if we can match your interests/needs to the expertise of the Center's staff.

If you did not receive this research update by mail and would like to do so, please contact the Center and we will place you on our mailing list.

Upcoming Events

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You can help us!

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